

# 3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor, Phase I

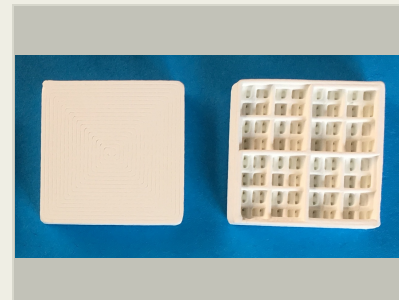
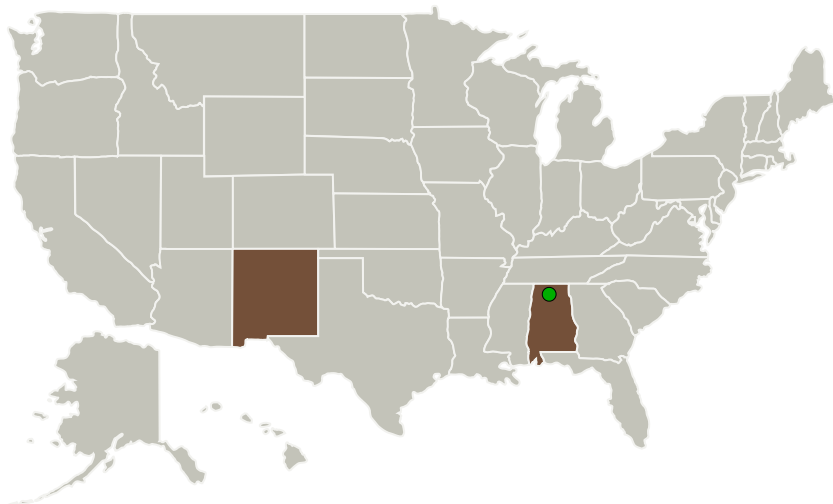
Completed Technology Project (2017 - 2017)



## Project Introduction

Using technology spun out from Sandia National Laboratories, Goodman Technologies LLC with our Small Business and Minority Institution partners (Team GTL) has demonstrated the feasibility of 3D printed metals and ceramics for low areal cost, ultra-lightweight mirrors and structures. Our technology development roadmap shows production of the first meter-class mirror segments in time for the 2020 Decadal Survey. Our 1.5-meter hexagonal silicon carbide segments will meet or exceed all NASA requirements for the primary mirror of a FIR Surveyor such as the Origins Space Telescope (OST), and may also provide a solution for the LUVOIR Surveyor. Our analysis and internal research and development show that we will achieve an areal density of 7.75 kg/m<sup>2</sup>, a cost to print of \$60K/segment, and an optical surface that has nanometer-scale tolerances. Our encapsulated lattice construction provides a uniform CTE throughout the part for dimensional stability, incredible specific stiffness, and the added benefit of cryo-damping. Our process will also allow for direct embedding of electronics for active structures and segments, and the potential for actively cooling with helium for unprecedented low emissivity and thermal control. Finally, the particulate paste extrusion process may be very suitable for printing mirrors in the zero gravity of space.

## Primary U.S. Work Locations and Key Partners



3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor, Phase I Briefing Chart Image

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3

# 3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor, Phase I

Completed Technology Project (2017 - 2017)



Organizations Performing Work	Role	Type	Location
Goodman Technologies, LLC	Lead Organization	Industry	Albuquerque, New Mexico
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	New Mexico

## Project Transitions

▶ **June 2017:** Project Start

✓ **December 2017:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140769>)

## Images



### Briefing Chart Image

3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor, Phase I Briefing Chart Image  
(<https://techport.nasa.gov/image/125726>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Goodman Technologies, LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

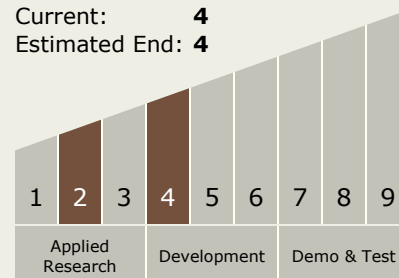
Carlos Torrez

### Principal Investigator:

William Goodman

## Technology Maturity (TRL)

Start: 2  
Current: 4  
Estimated End: 4



# 3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor, Phase I

Completed Technology Project (2017 - 2017)



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.2 Observatories
    - └ TX08.2.1 Mirror Systems